

## **AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

### **Listing of Claims:**

1           1. (Currently Amended) A method for communicating between a first  
2 semiconductor die and a second semiconductor die through optical signaling,  
3 comprising:  
4           converting an electrical signal into an optical signal using an electrical-to-  
5 optical transducer located on a face of the first semiconductor die;  
6           wherein the first semiconductor die and the second semiconductor die are  
7 oriented face-to-face so that the optical signal generated on the first  
8 semiconductor die shines on the second semiconductor die;  
9           passing the optical signal through annuli repeated on multiple~~located~~  
10 ~~within~~ metallization layers on the first semiconductor die to focus the optical  
11 signal onto the second semiconductor die;  
12           receiving the optical signal on a face of the second semiconductor die; and  
13           converting the optical signal into a corresponding electrical signal using an  
14 optical-to-electrical transducer located on the face of the second semiconductor  
15 die.

1           2. (Cancelled)

1           3. (Original) The method of claim 1, wherein after generating the optical  
2 signal on the first semiconductor die, the method further comprises using a lens to  
3 focus the optical signal onto the second semiconductor die.

1           4. (Original) The method of claim 1, wherein after generating the optical  
2 signal on the first semiconductor die, the method further comprises using a mirror  
3 to reflect the optical signal, so that the optical signal can shine on the second  
4 semiconductor die without the first semiconductor die having to be coplanar with  
5 the second semiconductor die.

1           5-6 (Canceled).

1           7. (Previously presented) The method of claim 1,  
2 wherein multiple spatially adjacent electrical-to-optical transducers in the  
3 plurality of electrical-to-optical transducers transmit the same signal; and  
4 wherein electronic steering circuits in the first semiconductor die direct  
5 data to the multiple spatially adjacent electrical-to-optical transducers to correct  
6 mechanical misalignment in  $X$ ,  $Y$  and  $\Theta$  coordinates.

1           8. (Previously presented) The method of claim 1,  
2 wherein multiple spatially adjacent optical-to-electrical transducers in the  
3 plurality of optical-to-electrical transducers receive the same signal; and  
4 wherein electronic steering circuits in the second semiconductor die direct  
5 data from the multiple spatially adjacent optical-to-electrical transducers to correct  
6 mechanical misalignment in  $X$ ,  $Y$  and  $\Theta$  coordinates.

1           9. (Original) The method of claim 1, wherein the electrical-to-optical  
2 transducer includes one of:  
3 a Zener diode;  
4 a light emitting diode (LED);  
5 a vertical cavity surface emitting laser (VCSEL); and  
6 an avalanche breakdown P-N diode.

1           10. (Original) The method of claim 1, wherein the optical-to-optical  
2 transducer includes one of:

- 3           a P-N-diode photo-detector; and  
4           a P-I-N-diode photo-detector.

1           11. (Currently Amended) An apparatus for communicating between  
2 semiconductor chips through optical signaling, comprising:

- 3           a first semiconductor die;  
4           a second semiconductor die;  
5           an electrical-to-optical transducer located on a face of the first  
6 semiconductor die, which is configured to convert an electrical signal into an  
7 optical signal;

8           wherein the first semiconductor die and the second semiconductor die are  
9 oriented face-to-face so that the optical signal generated on the first  
10 semiconductor die shines on the second semiconductor die;

11           ~~annuli located within~~annuli repeated on multiple metallization layers on the first  
12 semiconductor die configured to focus the optical signal onto the second  
13 semiconductor die;

14           an optical-to-electrical transducer located on a face of the second  
15 semiconductor die, which is configured to convert the optical signal received from  
16 the first semiconductor die into a corresponding electrical signal.

1           12. (Cancelled)

1           13. (Original) The apparatus of claim 11, further comprising a lens  
2 configured to focus the optical signal onto the second semiconductor die.

1           14. (Original) The apparatus of claim 11, further comprising a mirror  
2 configured to reflect the optical signal, so that the optical signal can shine on the  
3 second semiconductor die without the first semiconductor die having to be  
4 coplanar with the second semiconductor die.

1           15-16 (Canceled).

1           17. (Previously presented) The apparatus of claim 11,  
2 wherein multiple spatially adjacent electrical-to-optical transducers in the  
3 plurality of electrical-to-optical transducers transmit the same signal; and  
4 wherein electronic steering circuits in the first semiconductor die direct  
5 data to the multiple spatially adjacent electrical-to-optical transducers to correct  
6 mechanical misalignment in  $X$ ,  $Y$  and  $\Theta$  coordinates.

1           18. (Previously presented) The apparatus of claim 11,  
2 wherein multiple spatially adjacent optical-to-electrical transducers in the  
3 plurality of optical-to-electrical transducers receive the same signal; and  
4 wherein electronic steering circuits in the second semiconductor die direct  
5 data from the multiple spatially adjacent optical-to-electrical transducers to correct  
6 mechanical misalignment in  $X$ ,  $Y$  and  $\Theta$  coordinates.

1           19. (Original) The apparatus of claim 11, wherein the electrical-to-optical  
2 transducer includes one of:  
3           a Zener diode;  
4           a light emitting diode (LED);  
5           a vertical cavity surface emitting laser (VCSEL); and  
6           an avalanche breakdown P-N diode.

1           20. (Original) The apparatus of claim 11, wherein the optical-to-optical  
2 transducer includes one of:  
3           a P-N-diode photo-detector; and  
4           a P-I-N-diode photo-detector.

1           21. (Currently Amended) A computer system including semiconductor  
2 chips that communicate with each other through optical signaling, comprising:  
3           a first semiconductor die containing one or more processors;  
4           a second semiconductor die containing circuitry that communicates with  
5 the one or more processors;  
6           an electrical-to-optical transducer located on a face of the first  
7 semiconductor die, which is configured to convert an electrical signal into an  
8 optical signal;  
9           wherein the first semiconductor die and the second semiconductor die are  
10 oriented face-to-face so that the optical signal generated on the first  
11 semiconductor die shines on the second semiconductor die;  
12           ~~annuli located within~~annuli repeated on multiple metallization layers on the first  
13 semiconductor die configured to focus the optical signal onto the second  
14 semiconductor die;  
15           an optical-to-electrical transducer located on a face of the second  
16 semiconductor die, which is configured to convert the optical signal received from  
17 the first semiconductor die into a corresponding electrical signal.

1           22. (Cancelled)

1           23. (Original) The computer system of claim 21, further comprising a lens  
2 configured to focus the optical signal onto the second semiconductor die.

1           24. (Original) The computer system of claim 21, further comprising a  
2 mirror configured to reflect the optical signal, so that the optical signal can shine  
3 on the second semiconductor die without the first semiconductor die having to be  
4 coplanar with the second semiconductor die.

1           25-26 (Canceled).

1           27. (Previously presented) The computer system of claim 21,  
2 wherein multiple spatially adjacent electrical-to-optical transducers in the  
3 plurality of electrical-to-optical transducers transmit the same signal; and  
4 wherein electronic steering circuits in the first semiconductor die direct  
5 data to the multiple spatially adjacent electrical-to-optical transducers to correct  
6 mechanical misalignment in  $X$ ,  $Y$  and  $\Theta$  coordinates.

1           28. (Previously presented) The computer system of claim 21,  
2 wherein multiple spatially adjacent optical-to-electrical transducers in the  
3 plurality of optical-to-electrical transducers receive the same signal; and  
4 wherein electronic steering circuits in the second semiconductor die direct  
5 data from the multiple spatially adjacent optical-to-electrical transducers to correct  
6 mechanical misalignment in  $X$ ,  $Y$  and  $\Theta$  coordinates.

1           29. (Original) The computer system of claim 21, wherein the electrical-to-  
2 optical transducer includes one of:  
3           a Zener diode;  
4           a light emitting diode (LED);  
5           a vertical cavity surface emitting laser (VCSEL); and  
6           an avalanche breakdown P-N diode.

1           30. (Original) The computer system of claim 21, wherein the optical-to-  
2 optical transducer includes one of:  
3           a P-N-diode photo-detector; and  
4           a P-I-N-diode photo-detector.

1           31. (Previously presented) The method of claim 1, wherein after  
2 generating the optical signal on the first semiconductor die, the method further  
3 comprises passing the optical signal through an interposer sandwiched between  
4 the first semiconductor die and the second semiconductor die, wherein the  
5 interposer contains one or more waveguides that direct the optical signal, so that  
6 the optical signal shines on the second semiconductor die.

1           32. (Previously presented) The apparatus of claim 11, further comprising  
2 an interposer sandwiched between the first semiconductor die and the second  
3 semiconductor die, wherein the interposer contains one or more waveguides that  
4 direct the optical signal, so that the optical signal shines on the second  
5 semiconductor die.

1           33. (Previously presented) The computer system of claim 21, further  
2 comprising an interposer sandwiched between the first semiconductor die and the  
3 second semiconductor die, wherein the interposer contains one or more  
4 waveguides that direct the optical signal, so that the optical signal shines on the  
5 second semiconductor die.

1           34. (Previously presented) The method of claim 1,  
2 wherein the electrical-to-optical transducer is a member of a plurality of  
3 electrical-to-optical transducers located on the first semiconductor die; and

4            wherein the optical-to-electrical transducer is a member of a plurality of  
5 optical-to-electrical transducers located on the first semiconductor die;  
6            whereby a plurality of optical signals can be transmitted in parallel from  
7 the first semiconductor die to the second semiconductor die.

1            35.    (Previously presented)The apparatus of claim 11,  
2            wherein the electrical-to-optical transducer is a member of a plurality of  
3 electrical-to-optical transducers located on the first semiconductor die; and  
4            wherein the optical-to-electrical transducer is a member of a plurality of  
5 optical-to-electrical transducers located on the first semiconductor die;  
6            whereby a plurality of optical signals can be transmitted in parallel from  
7 the first semiconductor die to the second semiconductor die.

1            36.    (Previously presented)The computer system of claim 21,  
2            wherein the electrical-to-optical transducer is a member of a plurality of  
3 electrical-to-optical transducers located on the first semiconductor die; and  
4            wherein the optical-to-electrical transducer is a member of a plurality of  
5 optical-to-electrical transducers located on the first semiconductor die;  
6            whereby a plurality of optical signals can be transmitted in parallel from  
7 the first semiconductor die to the second semiconductor die.